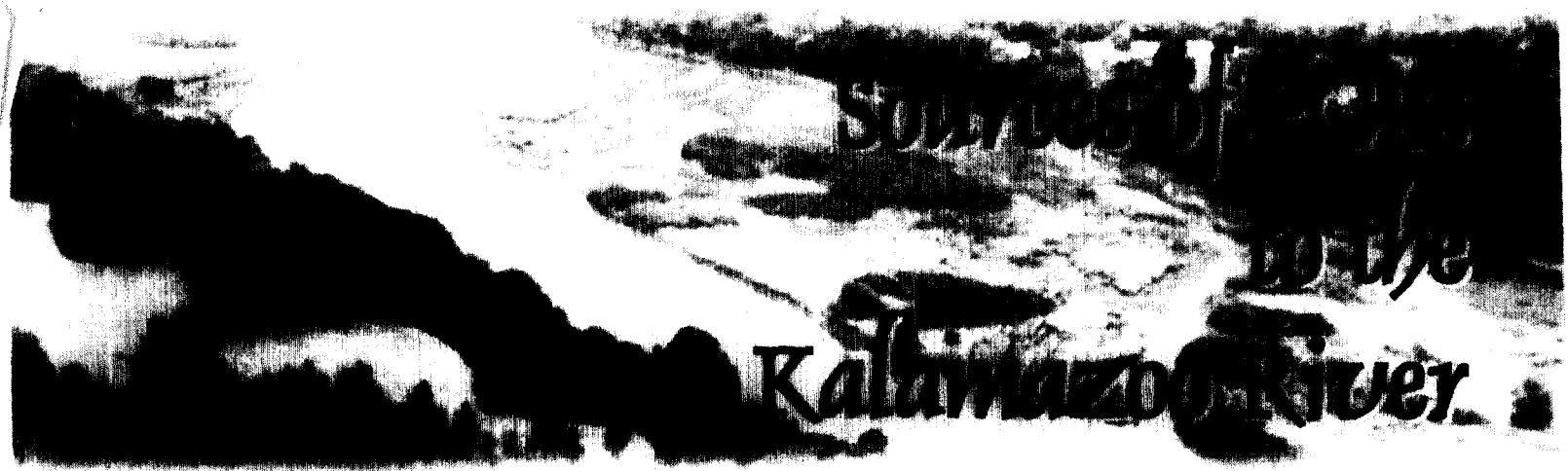


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***For many years, the paper recycling companies have studied what to do about PCBs (polychlorinated biphenyls) in the Kalamazoo River. While the recyclers do have a part to play, it must be recognized that more than half of PCBs in Kalamazoo River fish did not originate from paper recycling sources. This report discusses where those other PCBs came from, why they are important, and the evidence that they are not associated with paper recycling.***

The Kalamazoo River Superfund Site includes 35 miles of the river between Portage Creek in Kalamazoo and the Allegan City Dam in Allegan, plus the lower 3 miles of Portage Creek. The Site and over 40 miles of river upstream of Morrow Lake and downstream to Lake Michigan have been the focus of intensive environmental investigations since the early 1990s in an effort to identify the nature and extent of PCBs in the system. Although the focus has been on the PCB contribution of a few paper mills formerly owned and operated by the member companies of the Kalamazoo River Study Group (KRSRG), there is very clear evidence that a large number of other companies and sources have discharged significant quantities of PCBs to the river, and some of those discharges continue today.

Based on data collected from the Michigan Departments of Natural Resources and Environmental Quality (MDNR and MDEQ),<sup>1,2,3,4</sup> the U.S. Environmental Protection Agency (USEPA), the KRSRG, and others, this document briefly summarizes the sources of PCBs within the watershed, how PCBs have entered the river, and the important relationship today between PCBs found in sediment and those

found in fish. Taken together, there is clear evidence that PCBs in the Kalamazoo River are from a variety of sources, not just member companies of the KRSRG.

### ***Sources of PCBs to the Kalamazoo River***

For more than half of the 20<sup>th</sup> Century, PCBs were in widespread use throughout the Kalamazoo River watershed and the rest of the country. In fact, in 1972 the Federal Interdepartmental Task Force on PCBs stated that, "PCBs have been used so widely and over such a long period that they are ubiquitous."<sup>5</sup> In the Kalamazoo area (and elsewhere), PCBs were found in electrical transformers, capacitors, turbines, and pumps, and also were used as hydraulic fluids and lubricants, heat transfer fluids, plasticizers, surface coatings, adhesives, and pesticide extenders. They were used in offices, schools, municipal facilities, and industrial plants. In addition, from the late 1950s until the early 1970s, PCBs were used in the manufacture of carbonless copy paper. While carbonless copy paper was not made in the Kalamazoo River valley, a number of companies did recycle waste paper from government offices, schools, and businesses that included PCB-containing carbonless copy paper.

As a result of this widespread use, PCBs entered the river in a number of different ways. Before the advent of today's environmental regulations, many companies and municipalities discharged various kinds of waste, some of which contained PCBs, directly to the river. With so many facilities in the watershed purchasing and handling PCBs, there were also the inevitable accidental spills, and unfortunately, cases of intentional dumping of PCB-containing materials. Over time, some companies started sending

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*For more information on the Site, visit the Kalamazoo River Webline at [www.kzooriver.com](http://www.kzooriver.com).*

their PCB-containing waste to public wastewater treatment plants (WWTPs). While the WWTPs were able to remove some of the PCBs, handling PCB-containing waste turned the WWTPs into PCB dischargers as well. Finally, PCBs entered the Kalamazoo River via diffuse pathways such as runoff during rain storms and snow melt, and by atmospheric deposition.

Various sources of public information, including PCB sales records, effluent monitoring data filed with the MDNR, MDEQ's "Contaminated Sites in Michigan" database, and other data from MDNR, MDEQ, and USEPA all underscore the fact that PCB use and discharge was and remains a widespread issue throughout the watershed, not simply a problem associated with historical paper recycling. For example, a review of these records reveals a number of other sources of PCBs to the river in addition to the KRSG facilities. These sources are summarized below and listed on the next page.

- Of the nearly 200 sites in the watershed on Michigan's Part 201 Contaminated Sites list, 6 identify PCBs as a pollutant.
- 14 facilities are known to have discharged PCBs to the Kalamazoo River. Recent investigations by USEPA and MDEQ indicate recent or ongoing discharges of PCBs at 2 of these facilities.
- 16 facilities currently have soils containing elevated levels of PCBs on site. PCB concentrations as high as 53,000 milligrams per kilogram (mg/kg) were detected at one location.
- 11 facilities have had documented leaks or spills of PCB-containing materials.
- 35 facilities are known to have purchased or used PCBs or PCB-containing equipment and products.
- 4 other Superfund sites exist in the watershed. There is clear evidence that several of these sites have contributed substantial quantities of PCBs to the river.
- 5 facilities are known to have discharged PCBs to WWTPs that subsequently discharged PCBs to the river. In addition, state monitoring data show that PCBs were detected at 9 WWTPs in the watershed, providing evidence that a number of facilities have generated PCB-containing wastes.

While the PCBs in waste office paper recycled at the KRSG facilities were almost exclusively derived from Aroclor 1242 (only Aroclor 1242 was used in carbonless copy paper), other sources used and/or discharged Aroclor 1254 and Aroclor 1260, PCB mixtures that can not be attributed in any significant concentration to the waste paper recycling process. Since more than half of the PCBs found in Kalamazoo River fish have been quantified as Aroclor 1254 and Aroclor 1260 (the presence of PCBs in fish is a primary reason the Kalamazoo River is a Superfund Site), it stands to reason that these other PCB sources share liability for this Site.

### ***Not All PCBs Are Alike***

PCBs are a group of 209 different compounds, referred to individually as "congeners," that differ in the number and arrangement of chlorine atoms on the biphenyl molecule. In the United States, PCBs were produced as mixtures of PCB congeners for commercial purposes exclusively under the trade name Aroclor. Although most PCBs produced in the United States were used in manufacturing electrical transformers and capacitors, they were also used in other applications, including hydraulic fluids, cutting oils, heat transfer fluids, quench oils, and from 1957 through 1971, PCBs were used in the manufacture of carbonless copy paper.

The average chlorine content of a particular Aroclor product is, in most cases, evident in the specific product name. For example, Aroclor 1242 is 42% chlorine by weight, while Aroclor 1254 is 54% chlorine by weight. The PCBs discharged from paper mills were predominately derived from Aroclor 1242, which was used in carbonless copy paper. Aroclor 1242 also was used extensively in capacitors that were in widespread operation at facilities throughout the watershed.

## Summary of Other Sources of PCBs to the Kalamazoo River

### Documented Dischargers of PCBs (14) *GRAND TRUNK*

- Auto Ion Superfund Site, Kalamazoo
- Benteler Industries, Inc., Comstock Township
- Eaton Corporation, three facilities in Battle Creek, Marshall, & Kalamazoo
- Gould Paper Corporation, Kalamazoo
- Grand Trunk Western Railroad Heavy Repair Shop, Battle Creek
- Harvard Industries, Inc., Albion
- Hydro Aluminum Wells, Inc., Cooper Township
- Menasha Corporation, Otsego
- Rock-Tenn Company - Angell Street Mill, Battle Creek
- Rock-Tenn Company/Mead Corporation, Otsego
- Rockwell International Superfund Site, Allegan
- Union Steel Products, Inc., Albion

### Facilities with PCB-Containing Soils on Site (16) *EXPERIENCE?*

- Albion-Sheridan Township Landfill, Albion
- Brooks Foundry, Inc., Albion
- Bush Oil Company, Wayland
- Chase Manufacturing, Douglas
- Consumers Energy - Michigan Avenue, Kalamazoo
- Franklin Iron & Metal Company, Battle Creek
- Friedman Scrap and Supply Company, Kalamazoo
- Johnson Iron Industries, Charlotte
- Kalamazoo Metal Recyclers, Inc., Kalamazoo
- Michigan Disposal Service, Kalamazoo
- Panelyte, Kalamazoo
- Schupan & Sons, Inc., Kalamazoo
- SER Plating, Kalamazoo
- Union Steel & Wire, Battle Creek
- Viking Die Cast Corporation, Oshtemo
- West KL Avenue Landfill, Oshtemo Township

### Facilities with Documented Leaks and/or Spills of PCB-Containing Material (11) *ON PAPER?*

- Checker Motors Corporation, Kalamazoo
- City of Marshall
- Consumers Energy - Michigan Avenue, Kalamazoo
- Federated Publications, The Battle Creek Enquirer, Battle Creek
- Kalamazoo Regional Psychiatric Hospital, Kalamazoo
- Midwest Metallurgical Laboratory, Inc., Marshall
- Preferred Plastics, Inc., Plainwell
- Savage Rowe Plating Company
- Shay Motors, Battle Creek
- United Steel & Wire Company, Battle Creek
- Valleau Brass Foundry, Saugatuck

### Superfund Sites that Have Discharged/Handled PCBs (4)

- Albion-Sheridan Township Landfill, Albion
- Auto Ion Superfund Site, Kalamazoo
- Michigan Disposal Service, Kalamazoo
- Rockwell International Superfund Site, Allegan

### Part 201 Sites with PCBs as a Listed Pollutant (6)

- Brooks Foundry, Inc., Albion
- Consumers Energy - Michigan Avenue, Kalamazoo
- Johnson Iron Industries, Charlotte
- Panelyte, Kalamazoo
- Rockwell International Superfund Site, Allegan
- Shakespeare Company, Kalamazoo

### Facilities that Discharged PCBs to WWTPs (5)

- BASF Corporation, Kalamazoo
- General Motors Corporation - BOC Group, Kalamazoo
- Parker Hannifin Corporation, Otsego
- Pharmacia & Upjohn Company, Kalamazoo & Portage
- Shakespeare Company, Kalamazoo

### WWTPs with PCBs Detected in Effluent and/or Sludge Samples (9)

- Albion WWTP
- Allegan WWTP
- Battle Creek WWTP
- Charlotte WWTP
- Kalamazoo WWTP
- Marshall (Robert J. Swalwell) WWTP
- Otsego WWTP
- Plainwell WWTP
- Portage WWTP

### Purchasers and/or Users of PCBs (35)

- Albion Industries, Inc., Albion
- Armour Swift-Eckrich, Kalamazoo
- Battle Creek Federal Center, Battle Creek
- Borroughs Corporation, Kalamazoo
- Bronson Methodist Hospital, Kalamazoo
- C. Stoddard & Sons Oil Company, Wayland
- Cytec Industries, Inc., Kalamazoo
- David Brown Union Pumps Company
- DMS Electric Apparatus Service, Kalamazoo
- Drug & Laboratory Disposal, Inc., Plainwell
- Durametallic Corporation, Kalamazoo
- Fabri Kal Corporation, Kalamazoo
- Guardian Fiberglass, Inc., Albion
- Haworth, Inc., Douglas
- Hercules, Inc., Parchment
- Heritage Guitar, Inc., Kalamazoo
- Humphrey Products, Kalamazoo
- International Foundry Sales and Service, Battle Creek
- Kalsec, Inc., Kalamazoo
- Kellogg Community College, Battle Creek
- Knappen Milling Company, Augusta
- Lakeside Refining Company, Kalamazoo
- Marshall City Water and Electric Works, Marshall
- Mead Corporation, Kalamazoo
- Metal Components, Inc. - Flexible Furniture Div., Plainwell
- National Gypsum Company, Kalamazoo
- Park Trades Center, Kalamazoo
- Pet Life Corporation, Hamilton
- Ralston Foods, Inc., Battle Creek
- Rapa Electric, Inc., Allegan
- Rich Products Corporation, Saugatuck
- Rowen & Blair Electric Company, Kalamazoo
- The Kellogg Company, Battle Creek
- Veterans Administration Medical Center, Battle Creek
- Wolverine Power Supply Co-op, Dorr

Note: This list was compiled from a wide variety of publicly available records from several federal, state, and local sources.

### **History and Role of the Paper Industry**

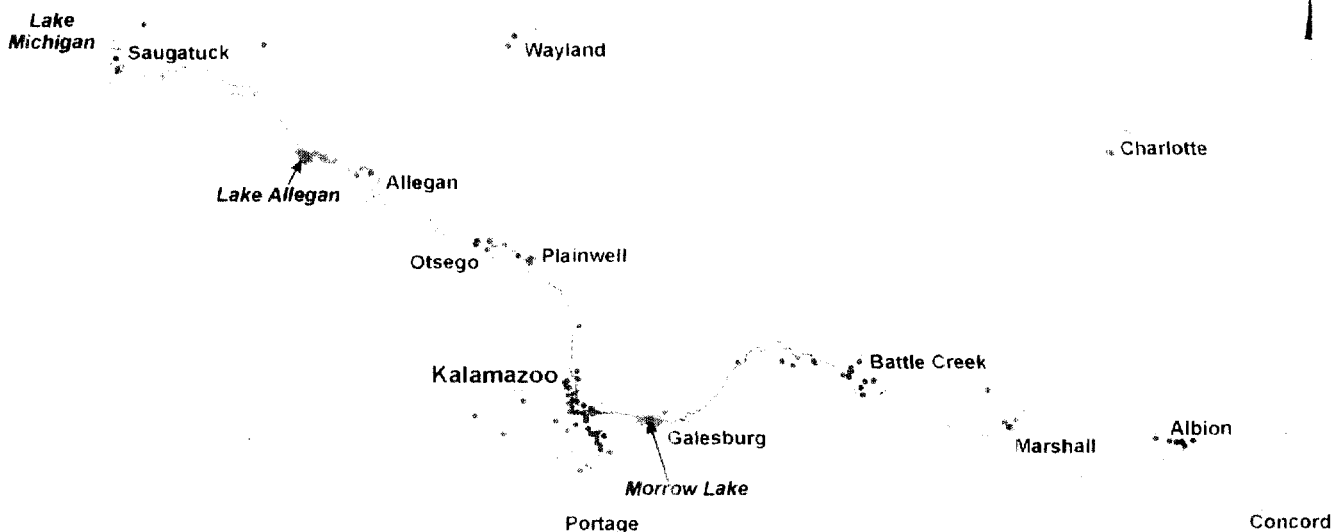
Starting in the 1950s, many paper mills across the northern United States, including those in the Kalamazoo area, began to recycle waste paper from government offices, businesses, and schools for stock to conserve resources and stay competitive.<sup>6</sup> Mixed in with the paper sent to the mills for recycling was carbonless copy paper, which between 1957 and 1971 contained Aroclor 1242 as an ink carrier or solvent.<sup>7</sup> The KRSNG mills did not benefit in any way from handling PCBs in this manner, and no KRSNG member companies manufactured carbonless copy paper – it was manufactured elsewhere by other companies.<sup>8</sup>

Concerns about PCBs in the general environment, first reported by Soren Jensen in 1966,<sup>9</sup> grew quickly in the United States, but PCBs were not identified as an

issue for the paper industry until 1971. By June 1, 1971 production of carbonless copy paper containing PCBs had stopped, although widespread recycling of all kinds of paper stock continued.<sup>10</sup> After PCBs were removed from newly-manufactured carbonless copy paper, there was a decline in PCB concentrations in paper products, effluents, and sludges<sup>11</sup> and the paper mills fully cooperated with a USEPA-sponsored effort to determine the level of PCB use in the pulp and paper industry.

Although the KRSNG does have a role to play in the recovery of the Kalamazoo River, that role cannot be an exclusive one, especially given the presence of Aroclor 1254-derived PCBs from non-KRSNG sources and their importance in driving the accumulation of PCBs in Kalamazoo River fish.

### **Sources of PCBs in the Kalamazoo River Watershed**



*Each of the dots on the map above represents one known or potential source of PCBs to the Kalamazoo River. Not shown are nearly 200 other hazardous waste sites managed or monitored by the MDEQ. It is clear that there are major sources of PCBs that cannot be attributed to paper recycling, and these sources should be identified and controlled if the problem of PCBs in the watershed is to be solved effectively.*

### ***Focus on Upstream Sources***

There is clear and undeniable evidence of PCB sources upstream of Morrow Lake Dam and all KRSG facilities. PCB discharges to the upper reaches of the river have been known since at least 1971, when the MDNR measured PCBs in fish at concentrations up to 18.7 mg/kg between Battle Creek and Morrow Dam.<sup>12</sup> That same report showed that upstream PCBs were quantified as Aroclor 1254, and acknowledged that "the form of Aroclors present would reflect different industrial uses responsible for the contamination." The MDNR also detected PCBs in the sediments of Morrow Lake during a July 1988 survey, and again the PCBs were quantified as Aroclor 1254.<sup>4</sup> In 2001, PCBs quantified primarily as Aroclor 1254 were detected at concentrations of 7.2 to 76 mg/kg in soil and sediment samples collected from below and within a storm sewer ditch that historically carried discharge to the Kalamazoo River from Eaton Corporation's Battle Creek facility, which is believed to be a significant source of PCBs to the river and Morrow Lake.<sup>13</sup>

Analyses conducted in support of the October 2000 Remedial Investigation (RI) report for the Kalamazoo River Superfund Site indicate that approximately 4,200 pounds of PCBs remain in the sediments of Morrow Lake, deposited there over time from upstream sources.<sup>14</sup> In addition, it is estimated that approximately 6,300 to 15,000 pounds of PCBs have already flowed over Morrow Dam and dispersed throughout the remaining river.<sup>15</sup> The presence of these predominantly Aroclor 1254-derived PCBs is clearly evident in downstream sediments and fish. For example, approximately half of the PCBs detected in fish from Lake Allegan are quantified as Aroclors 1254 and 1260.

Finally, the need for fish consumption advisories for Morrow Lake and the Battle Creek area make it obvious that there are PCB sources upstream of Morrow Dam and all KRSG facilities. Due to the presence of PCBs, Michigan's 2001 fishing guide recommends restricting consumption of carp caught from Morrow Lake. These types of advisories have been issued for Morrow Lake since 1987. Consumption advisories also are in place for carp from the Ceresco Impoundment, which is upstream of Battle Creek.<sup>16</sup>

### ***Focus on Sources Within the Site***

There are 4 other federal Superfund sites (with PCBs) within the Kalamazoo River watershed, and nearly 200 other hazardous waste sites are listed in Michigan's state-wide database of contaminated sites. In addition, there are dozens of facilities where PCBs (and many other contaminants) are known to have been purchased, used, spilled, or discharged. Further confirmation of PCB discharges to the river is found in the fact that PCBs have been detected in the effluent from nine public wastewater treatment plants in the watershed, although most detections were in the 1970s and 1980s.

There is clear evidence of PCB discharges at two of the federal Superfund sites. The Rockwell International Superfund Site in Allegan (owned by ArvinMeritor) appears to have directly and indirectly discharged PCBs to the river in wastewater, groundwater, and surface runoff. For example, USEPA and MDEQ have measured PCBs (quantified as Aroclor 1254) in sub-surface soils (up to 203 mg/kg), surface soils (up to 31 mg/kg), and an oily material (up to 260 mg/kg). The USEPA issued a unilateral Administrative Order in August 2001 to initiate interim removal actions and take over completion of remedial investigation studies, based in part on the finding that, "two plumes of oil contaminated with PCBs have been discovered leaving the site...and entering the Kalamazoo River."<sup>17</sup>

Similarly, the Auto Ion Superfund Site in Kalamazoo appears to have played a significant role in PCB discharges to the Kalamazoo River. For example, in 1982, the MDNR collected samples of sludge from the plant's basement, which revealed concentrations of PCBs quantified as Aroclor 1254 as high as 43,000 µg/L (micrograms per liter),<sup>18</sup> and a tunnel connecting the basement to the Kalamazoo River was discovered in 1985.<sup>19</sup> In 2000, elevated levels of PCBs were detected in sludge/surface sediment samples collected in the river near the historical outfall from the Auto-Ion facility. Total PCBs in the sample were measured at 69 mg/kg, and 51 mg/kg were quantified as Aroclor 1254.<sup>20</sup>

*There are currently 4,200 pounds of PCBs in Morrow Lake, and fish consumption advisories are in place for both PCBs and mercury in Morrow Lake and other upstream areas.*

**Why is Aroclor 1254 Relatively High in Fish but Relatively Low in Sediments?** The propensity for PCBs to accumulate in fish owes to their general affinity for fats and similar substances, as well as their relatively small capacity to dissolve in water. The octanol-water partition coefficient (*K<sub>ow</sub>*), is a chemistry term used to represent the propensity for chemicals to accumulate in aquatic organisms. *K<sub>ow</sub>* is basically the ratio of: 1) the extent to which PCBs accumulate in the fat-like substance octanol to 2) the extent to which PCBs remain in a dissolved phase. Scientists have developed estimates of *K<sub>ow</sub>*s for the 209 different PCB congeners and the Aroclor mixtures.

*K<sub>ow</sub>*s also have been useful to account for how PCBs move from sediment into aquatic organisms. Parkerton et al.<sup>21</sup> summarized available field data relating PCB levels found in aquatic animals (on a fat basis) to PCB levels in surface sediment (on an organic carbon basis). The ratios of the two, known as biota to sediment accumulation factors (BSAFs) were in turn related to the *K<sub>ow</sub>*s of PCBs. The data show an increase in BSAF with increasing *K<sub>ow</sub>*. Over the range of *K<sub>ow</sub>*s for Aroclor 1242 and 1254 (400,000 to 3,200 respectively, according to ATSDR<sup>22</sup>), the data show that BSAFs increase by slightly more than a factor of three. What does this mean? It means that other things being equal, for equal amounts of Aroclor 1254 and Aroclor 1242 in sediment, one expects to see three times the levels of the Aroclor 1254 components than Aroclor 1242 components in exposed aquatic animals. For Aroclor 1260, which is also present in Kalamazoo River sediments, the disparity between its bioaccumulation and that of Aroclor 1242 is even greater.

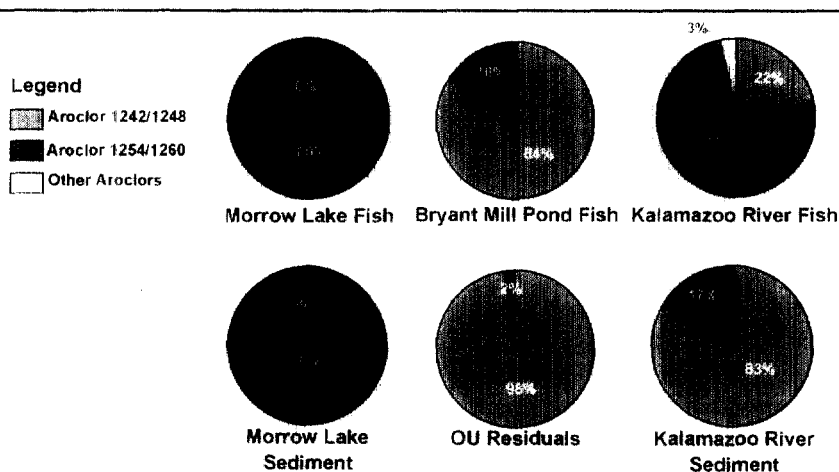
### Focus on PCB Fingerprinting in Fish

In environmental "forensic" detective work, laboratory analyses are used to "fingerprint" mixtures of chemicals to discriminate potential sources of those chemicals. The equipment used to test contaminated water, sediment, or other samples creates a detailed signature of the chemical mixture of a sample as it passes through the instrument. These unique signatures are called chromatograms. Using this powerful fingerprinting process, scientists are able to compare chromatograms to distinguish among the unique types and sources of PCBs.

It is important to carry out this kind of analysis because, as discussed above, not all PCBs come from the same sources and not all PCBs are alike. The "heavier" PCB mixtures like Aroclor 1254 and Aroclor 1260, which contain a higher percentage of chlorine by weight than Aroclor 1242, accumulate in fish to a far greater extent than the lighter PCB mixtures. Since eating fish containing PCBs is the primary way both humans and wildlife are exposed to PCBs on the Kalamazoo River, the concentration and kinds of PCBs in fish are of critical importance. The pie charts to the right clearly reflect a disproportionate accumulation of Aroclor 1254 and Aroclor 1260 congeners in fish. Even though a majority (83%) of the PCBs in sediment from the main river channel are quantified as the lighter Aroclor 1242 and Aroclor 1248, PCBs in fish from the river are predominately (75%) characterized as the heavier Aroclor 1254 and Aroclor 1260.

The figures on the next page feature examples of three different chromatograms of PCBs in fish (white sucker) from the watershed.<sup>14</sup> Each chromatogram is drawn by the test instrument over the 25 to 30 minutes required for the PCB mixture to be separated into its components in the gas chromatograph. Thus, a chromatogram can be interpreted from left to right as each chemical mixture creates a series of intensity "peaks" (measured on the vertical or "y" axis) during the test period (elapsed time is reported along the horizontal or "x" axis).

The chromatogram fingerprints are lined up vertically so that the differences between them can be seen.



**Kalamazoo River fish disproportionately accumulate Aroclor 1254-derived PCBs...** If PCBs throughout the Kalamazoo River were exclusively from sources involved in paper recycling, then we would expect the mixtures of PCBs to be the same regardless of location. As the pie charts above show, this is clearly not the case. Morrow Lake fish and sediment contain no PCB mixtures associated with paper recycling, while PCBs in samples from Bryant Mill Pond and the Site's operable units (OUs) are predominately quantified as Aroclor 1242. Samples from the main river channel show a blending of PCB sources, and provide clear evidence that fish disproportionately accumulate Aroclor 1254-derived PCBs, even though PCBs in sediments are quantified mostly as Aroclor 1242.<sup>25</sup>

Reference peaks to aid in the interpretation of representative PCB chromatograms are labeled A, G, and K. Because the sources and types of PCBs are different among these samples, the chromatograms themselves are quite different as well. For example:

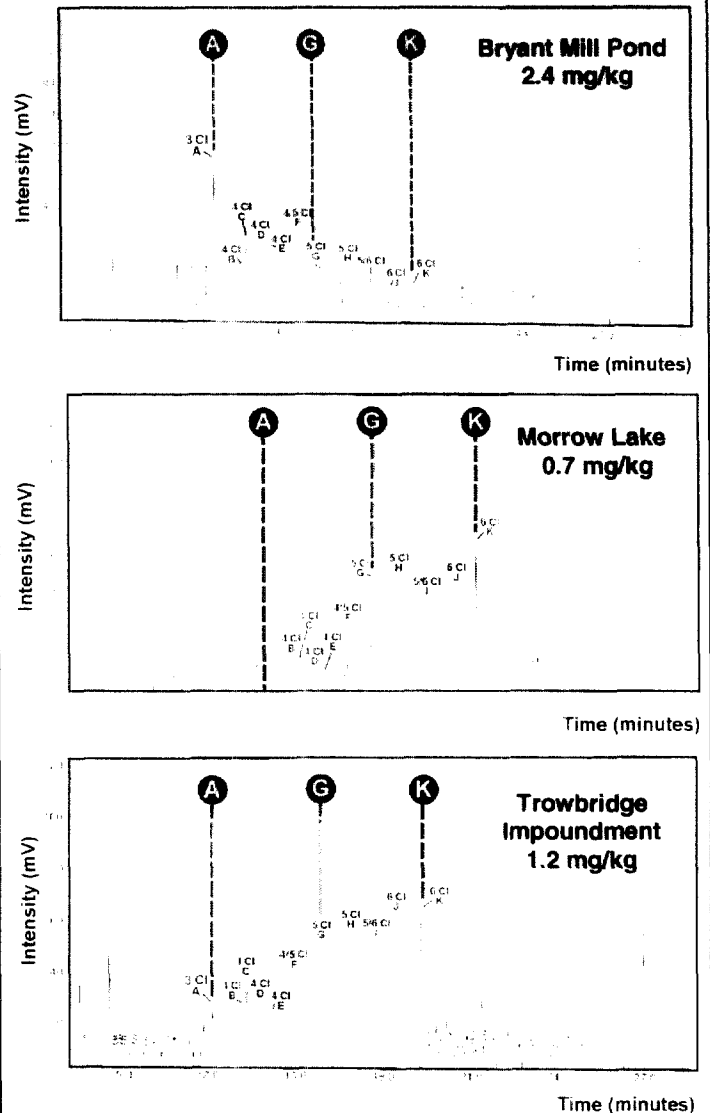
- *Bryant Mill Pond sample* – The predominant peaks (from Peaks A through G) appear relatively early in the chromatogram. This pattern is weathered, but still sufficiently similar to the Aroclor 1242 chemical standard, so the laboratory quantified the sample as comprised mostly of Aroclor 1242, which is the primary PCB mixture found in the carbonless copy paper sent to Kalamazoo valley paper mills with office paper and other secondary fiber for recycling.

The Allied Paper, Inc. mills appear to have been the predominant source of PCBs to Bryant Mill Pond,<sup>23</sup> a now remediated area of the Superfund Site that was an impoundment of Portage Creek, a relatively small tributary of the Kalamazoo River. The composition of PCBs in Bryant Mill Pond fish before remediation is therefore a useful benchmark for the composition of PCBs in Kalamazoo River fish if the only sources of PCBs to the River were paper recycling operations.

- *Morrow Lake sample* – Morrow Lake is located upstream of all KRSG mills on the Kalamazoo River; therefore, this sample is representative of conditions associated with a subset of non-KRSG sources of PCBs. This chromatogram is very different from the Bryant Mill Pond example in that the predominant peaks (between Peaks G and K) appear relatively late in the chromatogram. This pattern is remarkably similar to Aroclor 1254 with relatively little weathering evident.
- *Trowbridge Impoundment sample* – Because the former Trowbridge Impoundment is many miles downstream of Morrow Lake and a number of other PCB sources, this sample represents the combined influence of paper recycling and these other direct and indirect sources of PCBs. The predominant peaks in this chromatogram are distributed between Peaks A and K. The peaks associated with Aroclor 1242 are still evident to the left of Peak G; however, in contrast to the Bryant Mill Pond chromatogram, the peaks between G and K are prominent. This reflects a blending of PCB sources, including Aroclor 1254 and Aroclor 1260.

If all the PCBs in the Kalamazoo River were exclusively from sources involved in waste paper recycling, then we would expect fish PCB chromatograms to resemble the fingerprints from Bryant Mill Pond. However, this is definitely not the case. The chromatograms of Kalamazoo River fish

### Chromatogram "Fingerprints" of PCBs in Fish



When PCB samples are analyzed in the laboratory, the testing instrument produces a chromatogram like those shown above. By interpreting the specific intensity (height) and timing of each peak, scientists can use chromatograms like fingerprints to identify what type of PCB congener is in the sample and what type of source it came from. Thus, the specific patterns differ between samples of fish (white sucker) taken from Bryant Mill Pond (representative of PCBs associated with waste paper recycling) and Morrow Lake (representative of other industrial PCB sources). The Trowbridge Impoundment sample chromatogram represents the downstream blending of these types of PCBs. Samples shown contained total PCB levels of 2.4 mg/kg, 0.7 mg/kg, and 1.2 mg/kg, respectively.<sup>24</sup>

collected downstream of Morrow Lake are like the one from the Trowbridge Impoundment, which shows a blending of PCBs spanning the compositions of Aroclors 1242, 1254, and 1260 and representative of the variety of sources and types of PCBs historically discharged to the system. In addition, the chemical fingerprints of PCBs from the KRSRG paper residual disposal area operable units (King Highway Landfill OU, Willow Boulevard/A-Site OU, 12<sup>th</sup> St. Landfill OU) show that PCBs in these areas contain 95 to 99 percent Aroclor 1242-derived PCBs, with only minor amounts of the higher-chlorinated PCBs (Aroclors 1254 or 1260) associated with non-paper sources. The chemical composition of these paper residuals clearly show that discharge of paper wastes can not account for the significant quantities of Aroclor 1254-derived PCBs in the river system.

### ***Summary: The Evidence Is Clear***

A substantial body of documented evidence makes clear the fact that scores of companies in the Kalamazoo River watershed have purchased and used PCBs and PCB products. Further, there is substantial and incontrovertible direct evidence from the USEPA, MDEQ, MDNR, and others that many of these have discharged to the Kalamazoo River. It is very clear that sources of PCBs that cannot be attributed to waste paper recycling contribute substantially to the levels of PCBs seen in fish, sediments, and other media.

Moreover, the higher-chlorinated PCBs from the non-KRSRG sources are known to accumulate in fish to a greater extent than the PCBs associated with paper recycling. This means that as the KRSRG sources are controlled, the continuing contributions from other sources of PCBs will increase in relative importance over time. Given the fact that reducing PCBs in fish tissue is a primary goal of remedial efforts on the river, the effectiveness of remediation implemented only downstream of Morrow Dam will be undermined or substantially limited as long as PCBs continue to enter the system from upstream and from other sources within the watershed.

The purchase, use, and discharge of PCBs within the Kalamazoo River watershed has been known and clearly documented for more than 30 years. In this time period, the USEPA, MDEQ, and others have amassed enough data to prove that numerous contributors of PCBs exist, yet only a small number of companies are currently legally bound to respond. Although members of the KRSRG do have a role to play in addressing PCB issues in the river, it is clear that the historical and future presence of PCBs in the watershed is not just a paper problem; it is a problem that all parties, government agencies, and communities need to solve in an equitable and technically sound manner.

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### ***Endnotes***

<sup>1</sup> Biological Survey of the Kalamazoo River, June – August 1971, Michigan Water Resources Commission, Bureau of Water Management, Department of Natural Resources, April 1972.

Page 73: “A significant increase in PCB’s occurred in the zone downstream from the Battle Creek WWTP. The ten fish analyzed (including carp, white suckers, rock bass, northern pike, and bullheads) from three locations between Battle Creek and Kalamazoo contained PCB’s ranging from 0.82 to 18.75 mg/kg.”

<sup>2</sup> Biological Survey of the Kalamazoo River, June – August 1971, Michigan Water Resources Commission, Bureau of Water Management, Department of Natural Resources, April 1972.

Page 77: In regard to PCBs in settleable solids – “The sample from the Battle Creek River had the highest concentration (0.422 mg/kg) detected in the watershed. This concentration indicates that a source or sources of PCB contamination exists upstream from the sampling site which would be contributing to the total problem in the mainstream.”

<sup>3</sup> April 13, 1977 MDNR memo from John Wuycheck, Biology Section to Karl Zollner, Regional Engineer; Chester Harvey, District 3; Bob LaMere, Municipal Facilities and Planning; and Ernie Jousma, Comprehensive Studies regarding samples collected during the Kalamazoo River intensive survey of 1976. The memo states that Aroclor 1254-derived PCBs were detected in settleable solids at the River Road sampling station and in sediments at both the 35<sup>th</sup> Street sampling station and in Morrow Lake.

<sup>4</sup> Qualitative Biological Survey of Kalamazoo River, Near Battle Creek, Michigan, Calhoun and Kalamazoo Counties, July 7, 1988, Michigan Department of Natural Resources, Surface Water Quality Division, March 1990 Staff Report.

<sup>5</sup> Polychlorinated Biphenyls and the Environment, Interdepartmental Task Force on PCBs, Washington, D.C., May 1972. COM-72-10419.

<sup>6</sup> “Kalamazoo was once a paper manufacturing giant,” *Kalamazoo Gazette*, September 2, 2001, by B. Walters.

<sup>7</sup> PCBs Involvement in the Pulp and Paper Industry, report prepared by Versar, Inc. for the USEPA, February 25, 1977. Page 2.

<sup>8</sup> Versar, Inc. 1977. Page 2.



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- <sup>9</sup> Versar, Inc. 1977. Page 1.
- <sup>10</sup> Versar, Inc. 1977. Page 1.
- <sup>11</sup> Versar, Inc. 1977. Page 4.
- <sup>12</sup> Biological Survey of the Kalamazoo River, June – August 1971, Michigan Water Resources Commission, Bureau of Water Management, Department of Natural Resources, April 1972. See Table 26 (p.71) and page 73 that states: “The data suggests that a very significant PCB contamination problem exists in the Kalamazoo River basin and that the probable sources are within the cities of Battle Creek and Kalamazoo.”
- <sup>13</sup> Sampling conducted by SCS Engineers and discussed in “Report Regarding the Environmental Response at the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site, Eighth Addendum to April 7, 1997 Report,” October 9, 2001, by Mark P. Brown, Ph.D.
- <sup>14</sup> Draft Remedial Investigation Report – Phase I, Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site, October 2000, Kalamazoo River Study Group. See primarily Section 5 and Appendix K. See also, “PCB in the Kalamazoo River: Update for Decision Makers – Latest Findings for Sediment, Surface Water, and Fish,” August 2001, Kalamazoo River Study Group.
- <sup>15</sup> Assessment of Contribution of PCBs to the Kalamazoo River from Eaton Corporation, April 17, 1997, by J.P. Connolly, HydroQual, Inc.
- <sup>16</sup> Michigan 2001 Fish Advisory, Michigan Department of Community Health.
- <sup>17</sup> USEPA issued a 106(e) Administrative Order under authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; the “Superfund” law) in August 2001 to perform an interim removal action to address PCB seeps, eroding soils, and other issues at the site. In 1998, USEPA issued a Notice of Determination to the owner, stating that “Meritor was unable to or unwilling to perform a satisfactory, proper, or prompt RI/FS” after four draft RI reports had been submitted since 1988 and rejected as “unacceptable.”
- <sup>18</sup> Remedial Actions Master Plan, July 30, 1984. This report (anonymous author) is part of the Site's official Administrative Record, and a copy of it was obtained from the MDEQ.
- <sup>19</sup> “Rooney claims state, city forced Auto-Ion abandoning,” *Kalamazoo Gazette*, March 28, 1985, by M. Van Buren.
- <sup>20</sup> Results of sediment samples collected by Blasland, Bouck and Lee, Inc. in 2000. Location of sample collected at the Auto-Ion facility historical outfall is near sediment sampling transect KPT-20, established in the original 1993/94 Remedial Investigation for the Kalamazoo River Superfund Site. Identification number of sample reported is K53922/KP2F-6.
- <sup>21</sup> “Do Aquatic Effects or Human Health End Points Govern the Development of Sediment-Quality Criteria for Nonionic Organic Chemicals?” by T.F. Parkerton, J.P. Connolly, R.V. Thomann, and C.G. Uchrin, *Environ. Toxicol. and Chem.*, 12:3, p. 507-523, 1993.
- <sup>22</sup> Toxicological Profile for Polychlorinated Biphenyls, Agency for Toxic Substances and Disease Registry, November 2000.
- <sup>23</sup> Spills of Aroclor 1248, 1254, and 1260 from the Panelyte facility may also have contributed some PCBs to Bryant Mill Pond.
- <sup>24</sup> Fish data presented for Kalamazoo River and Morrow Lake include 1993, 1997, and 1999 datasets for both smallmouth bass and carp; Bryant Mill Pond data are for carp from 1993 only. Sediment data for Kalamazoo River include all sediment samples collected since 1993, including 2000 cores, weighted by the mass of PCB in each reach presented in the Remedial Investigation report. The percents were derived by summing the Aroclor concentration for each reach, weighting that sum by the fraction of total mass in that reach (from the RI), summing all the weighted sums of the individual reaches, and taking the percent of the total, for a river-wide, PCB mass-weighted average. Sediment data for Morrow Lake are from 2000 dataset only; OU residuals data are from 1993/94 sampling event.